FAA
general aviation NEWS
SEPTEMBER—OCTOBER 1981
A DOT / FAA FLIGHT OPERATIONS SAFETY PUBLICATION

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FAA GENERAL AVIATION NEWS

**DEPARTMENT OF TRANSPORTATION/
FEDERAL AVIATION ADMINISTRATION**

SEPTEMBER-OCTOBER 1981
Volume 20, Number 5

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Walter Luffsey, *Assoc. Admin., Aviation Standards*
Kenneth S. Hunt, *Director, Flight Operations*
Bernard A. Geier, *Chief, General Aviation and Commercial Division*
David Gelfan, *Editor*
P. A. Duncan, *Assoc. Editor*, Louise Oertly, *Ass't Editor*

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FAA GENERAL AVIATION NEWS is sold on subscription at $6.20 per year (individual copies $1.10 Domestic, $1.40 Foreign) by the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Use the self-mailer order form in the centerfold of this magazine to subscribe. Prices are subject to change without prior notice.

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BRIEFS

IMPROPER IMPROVISING. A Cessna 210 pilot, who damaged his propeller landing with the nose wheel jammed in the retracted position, was understandably annoyed to learn that the cause was a piece of graphite (pencil lead) stuck in the hydraulic line. Investigation disclosed that a mechanic had used a lead pencil as a quick, cheap means of plugging the line while performing recent service on the gear mechanism. Apparently when he pulled the pencil out the lead broke off and remained in place. Pennywise, but "plane" foolish.

RECORD SETTING BALLOON. The first unmanned balloon crossing of the Atlantic was attempted earlier this year—unintentionally. An Adams A50S hot air balloon, being inflated in a baseball field in Alabama, took off on its own when all 16 stainless steel suspension cables broke. The balloon was last seen at 44,000' headed over the ocean. Cables should be inspected periodically by a certificated mechanic for breaks, kinks, and heat damage.

CREDIT SQUEEZE. Incidents involving near fuel exhaustion—as a consequence of inadequate credit arrangements—have been reported by pilots who arrived at a fueling stop only to find the supplier would not accept a personal check or company credit card. Check with the airport in advance or carry widely acceptible forms of payment.

SKID ROW. Failure to release the parking brake before takeoff led to the fatal crash of a Falcon 10 at Chicago's Miegs Field last January 1980. The corporate jet with six on board skidded off runway 18 on takeoff and sank in Lake Michigan, resulting in two deaths. Investigation revealed that unreleased brake drag prevented the aircraft from reaching rotation speed. Although there is a warning light on the panel for parking brakes there was no item on the pre-takeoff checklist covering it. If your pre-takeoff checklist does not include "Parking brake—OFF" pencil it in—now.

AIM HIGHER, OFTENER. The Airman's Information Manual, an FAA publication which explains and continuously updates basic flight information and air traffic control procedures, will be issued every 16 weeks (instead of every six months)beginning in January 1982. The price will increase to $14 per year. More frequent publication,concurrent with controller manual updating, will mean greater safety, permitting procedural changes to be made known simultaneously to the public.

Airborne Roller Coaster

"Walk wide o' the Widow of Windsor," advised Rudyard Kipling, and the same advice can be applied to the "widow-makers" of the summer and fall flying season—thunderstorms. The violent updrafts and downdrafts associated with thunderstorms often are experienced miles in front of the storm, so that merely avoiding the area of cloud and precipitation is not enough of a safeguard, particularly for pilots of small aircraft. Weather of this kind should be skirted by 15 to 20 miles, and when this is not possible you had better consider landing and waiting for the disturbance to move past. One midwestern pilot who recently tried to steer his way around a thunderstorm with the help of air traffic radar got taken for the wildest kind of roller coaster ride imaginable.

On a hot day in June Wallace Bontrager and two friends departed Kansas City, MO in a Cessna 172 for a flight to Liberal, in the southwestern tip of Kansas. According to Walllace, a professional pilot with nearly 2,000 hours of flying experience and a background in flight instruction, the weather was overcast to 3,800 feet and clear on top. He

filed IFR and took off at 5:45 a.m., hoping to avoid the thunderstorms which were forecast for the area later in the day.

The first hour of the flight was uneventful. Then the Kansas City air route traffic control center advised that rain showers and thunderstorms reported over Dodge City were moving in the direction of his flight path. The pilot asked for a deviation around the weather and was offered a more southerly airway, Victor 516, which on the Center radar appeared to be outside the reported shower area.

The pilot altered course accordingly, but encountered increasingly heavy rain. As he was attempting to discuss the situation with Kansas City (strong static was interfering with transmissions) he suddenly found his 172 caught in a sharp updraft and then bombarded with hail that broke through the windshield.

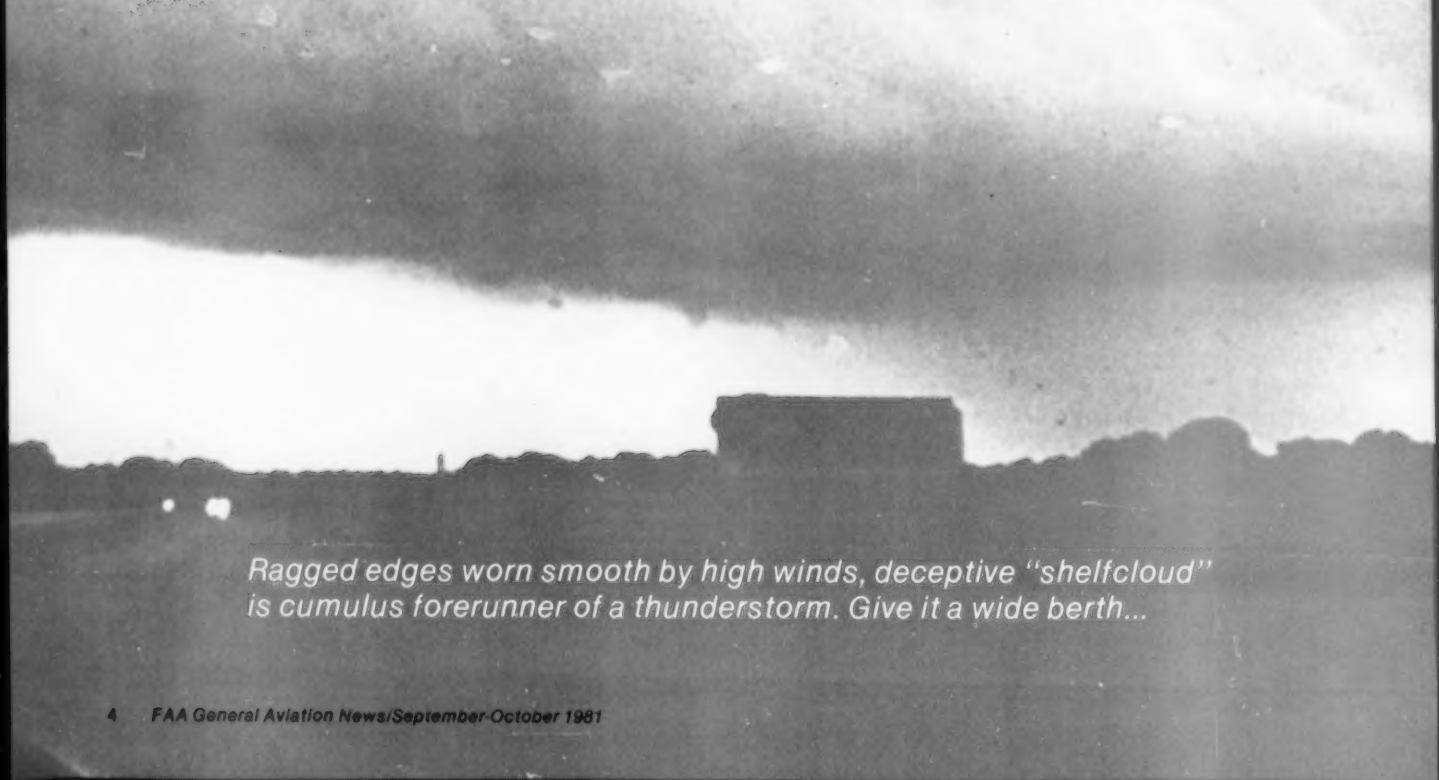
A few moments later the aircraft entered a downdraft and plunged toward the earth with the vertical speed indicator showing a very high rate of descent. The pilot, who had frequently lectured students on the importance of attitude flying if they were ever so unfortunate as to be caught in a thunderstorm, had his first real opportunity to practice what he had been preaching. Understanding the importance of avoiding structural damage, he resisted the desire to add power or attempt to counter the descent, which continued at what seemed a tremendous rate. By reducing power he kept the airspeed within a safe range, and he managed to keep the wings fairly level.

He knew that the descent rate would slow down near the ground, but because of the demolished windshield and the hail he had great difficulty seeing anything outside of the airplane, and he knew he would have no opportunity to select a landing area. Protecting his eyes with his clipboard he managed to just catch a glimpse of the ground prior to impact and was able to raise the nose slightly—enough, as it turned out, to absorb the landing shock on the main gear, although the nose gear collapsed shortly after touchdown and the airplane slid approximately thirty feet before nosing over and coming to a stop.

The aircraft was pretty badly smashed, but miraculously Wallace and his passengers climbed out of it with little more than a scratch. They had landed in a soggy wheatfield, and after locating the farmhouse were able to summon assistance and the police.

Wallace and his friends were lucky. Most light aircraft caught in severe up and down drafts come to grief as a result of structural damage or loss of control. Wallace's wild ride in the 172 lasted only a few minutes and he was so busy trying to protect himself from hail and keeping the airplane rightside up that he hardly had time to become frightened or panic. He was thankful that the proper procedures had been firmly imprinted in his mind, from repeated instruction on the subject, so that he was able to do the right things without mulling over his desperate situation.

Upon reflection he concluded that it was not a good idea to get as close as he had to a summer storm system in a light plane, or to rely on long range radar to keep him safely away from the path of an oncoming storm when a precautionary landing could have been made without difficulty. Vectors around weather from air traffic control are based on the best information available from radar and radio, but the pilot—not the controller—is responsible for deciding when it is safe to proceed. ■



Ragged edges worn smooth by high winds, deceptive "shelfcloud" is cumulus forerunner of a thunderstorm. Give it a wide berth...

Northrop's Flying Wing

"What's that up in the sky? The shape's all wrong to be an airplane. It's got to be something from Mars or outer space! Quick, call the Air Force or the FBI or somebody and report it!"

That was the reaction of many people in 1948–49 when they saw the *Flying Wing* being tested in the California skies—especially at night with lights outlining its boomerang shape. No fuselage, no tail, no rudder or nose cone, only a gigantic swept-back wing. But this radical aircraft, far from being a Martian marauder, was the brain child of an American aeronautical designer named Northrop, who had never been content to follow traditional pathways. The reasons why production of this revolutionary design was abruptly stopped and existing prototypes scrapped remained a mystery for 30 years, and even the explanation Northrop gave just before his death fell short of complete clarification.

John Knudsen Northrop was born in Newark, NJ on November 10, 1895, but grew up in Santa Barbara,CA where his father had moved the family to set up a construction business. After finishing high school in 1913, he spent the next three years tinkering with scientific projects which had always fascinated him. In 1916 he took a job as an engineer with the Loughead (later Lockheed) Aircraft Manufacturing Co. working for the two founding brothers, Allan and Malcolm. On his application Northrop listed his qualifications for the job: "I have a little experience as a garage mechanic, and I worked for a year as a draftsman. I believe this qualifies me to design airplanes." His first task was to design the wings for their F-1, a large twin-engine flying boat being built in competition with Curtiss for a military contract.

Although Curtiss won out, the Lougheads were impressed with Northrop and continued to employ him as a designer until 1920, when they temporarily ceased operating. In 1923 Northrop took a job with Douglas Aircraft in Los Angeles, designing fuel tanks for the Army Air Service's "World Cruisers,"—lightweight tanks that would hold maximum fuel with minimal increase in weight or drag. His design was so successful that Ryan Aviation then "borrowed" him from Douglas to redesign the wing of their M-1, a prototype of the famous monoplane that Lindbergh chose for his Atlantic crossing.

After his stint with Douglas and Ryan, Northrop rejoined Allan Loughead in 1927 and created the *Vega*, the first successful all-metal-covered cantilever-wing aircraft. Powered by a 220 hp Wright J-5 radial air-cooled engine, the *Vega* was far ahead of its time, proving itself the fastest commercial craft in the skies. It was the plane flown around the world by Wiley Post, across the Atlantic and Pacific by Amelia Earhart, and to the North Pole.

Joining Douglas Aircraft in 1932, Northrop began designing a series of sleek successors to the *Vega*—the *Alpha*, *Beta*, *Gamma* and *Delta* aircraft, which set world records for speed, endurance, and altitude, as well as earning a reputation for sturdiness and all-weather capability. Northrop also designed the early series of Douglas commercial airliners, the DC-1, DC-2 and the incredibly successful, DC-3.

Now firmly established as a government supplier of armament, Northrop returned to his earlier "dream-plane" design, the *Flying Wing*. By the war's end, the Air Force was seeking a replacement for its long range bomber, the B-29, and the choice apparently was narrowed down to Convair's B-36 and Northrop's *Flying Wing*.

Northrop's intention was to provide unprecedented speed, range and payload by eliminating all possible drag. The aircraft was one huge swept-back wing with no fuselage and with cockpit, crew, engines, and bomb bay inside the airfoil itself. The four-engine propeller model (called the XB-35) that was first flown in 1946 and had a wing-span of 172 feet, a length of only 53 feet, and a height of just over 20 feet. Each of its four engines had two counter-rotating pushers propellers, developing a total of 12,000 horsepower. The XB-35 had a useful load capacity of 73,000 lbs.—over 80% of its empty weight. (By comparison, a modern B-727-200 weighs 98,000 lbs. but has a useful load of less than half its weight—around 40,000 lbs.)

1947 brought the first flight of the XB-25's jet-propelled sistership—the YB-49. Dimensions and weight were similar to the B-35, but airspeed was in the order of 500 knots. Powered by eight GE J-35 engines each capable of 4,000 lbs. of thrust, the jet-powered "wing" could deliver 37,000 lbs. of bombs or cargo 1,250 miles away in less than 2½ hours. Normal 10,000 lb. loads could be *delivered up to a range of 4,000 miles with ample fuel reserves.* In 1949 a YB-49 flew from Edwards AFB in California to Andrews AFB near Washington, DC in four and a half hours, averaging 510 knots.

Based on the highly successful testing of both planes and the eager response of the Air Force, the future of Northrop's dream plane looked bright. A contract called for Northrop to deliver 35 *Wings* immediately, with the possibility of another 200 later. Northrop was ecstatic.

But in October of 1949 the Secretary of the Air Force abruptly cancelled the contract. The aviation industry, which had been looking forward to a long-term demonstration of the *Flying Wing's* unique characteristics, before deciding whether to fall in line, was astonished. What had gone wrong?

No one knew—or no one was telling, least of all Jack Northrop. He stolidly ordered the existing "Wings" scrapped and continued to produce aviation components for the military. In 1952, at a relatively young age of 57, Northrop retired, citing poor health. Friends believed he had been devastated by the destruction of his lifelong dream. For 30 years a reclusive Northrop refused to discuss the subject. Not until December of 1980, when he was seriously ill, did he offer a single comment.

Then in a nationally televised (previously taped) interview he stated that the *Flying Wing* had been cancelled because of his refusal to obey an Air Force command to merge his small company with the larger Convair Corporation, his chief competitor for the mammoth Air Force bomber contract. The master designer would not be subordinated—but he had kept his silence, he said, to insure the survival of his company, which depended on military contracts. Northrop died three months later, before anyone could verify that no essential design failure had led to the demise of the YB-49. Rumor has since suggested that major aircraft manufacturers are giving another hard look at the Flying Wing design as a means of countering unusually high fuel costs. Perhaps the dream will outlive the dreamer. ■

THE UNDERLYING CAUSE II

NIGHT FATIGUE

Federal investigators of aircraft accidents become accustomed to the sometimes grim aspects of the job, but derive satisfaction in knowing their work may prevent additional loss of life and property. What troubles these investigators is the occasional unsolved case, the accident that "just shouldn't have happened. *No word of trouble from the pilot, no evidence of mechanical failure, no weather problems, no trace of physical incapacitation*—still an aircraft flies into the gound or water or disappears with no survivors. About 50 aviation accidents investigated annually in the United States by the National Transportation Safety Board bear the tag, Cause Undetermined. That label bothers some investigators who fear that an unsolved case, like an unsolved crime, means that an unknown hazard is still present.

Ronald Schleede is one of these concerned individuals who still wakes up at night occasionally wondering about an accident he investigated for the Safety Board in Gallup, NM on March 3, 1978. This involved a "mercy flight," with the Gallup Flying Service being called upon in the middle of the night to airlift a doctor's patient from a small Arizona hospital to a larger facility in Albuquerque. The company pilot on duty agreed to make the flight, filed a flight plan and took off in VFR weather over a route with which he was thoroughly familiar. But the plane crashed before reaching Arizona, killing the pilot (the lone occupant) instantly.

Investigation of this accident was difficult for Schleede from the very beginning. The aircraft, a Cessna 320 (turbo-charged twin), had crashed with an explosive force that scattered wreckage over a 400 foot area. Fire and impact damage rendered many of the components almost unrecognizable. A painstaking reconstruction and examination of all evidence on the site was necessary before Schleede was satisfied that mechanical failure could be ruled out. Engine and airframe records showed that the aircraft had been maintained in full accordance with regulations, with no history of significant problems. Air traffic records indicated no reported hint of inflight difficulties. The airplane had apparently been flown into the ground with both engines functioning normally.

Reconstructing the history of the flight, Schleede established that the young pilot had been assigned the responsibility on this particular evening for responding to emergency calls. During the daytime he had attended to various duties at the airport but had not flown. He apparently spent the evening alone at home and retired at a normal hour. About midnight he received a call from a physician at Window Rock, AZ, requesting immediate air transportation for a seriously ill infant to a hospital in Albuquerque.

The pilot had called Gallup FSS, was briefed on the weather, and filed a VFR flight plan to be opened upon his departure from Window Rock (about 16 miles from Gallup). He drove to Gallup Airport, readied an airplane and took off at approximately 1:35 a.m. He did not contact air traffic service again.

About eight miles northwest of Gallup a group of Indians on the ground had heard an aircraft overhead about 1:45 that morning, and then shortly afterwards a loud explosion somewhere in the remote darkness.

An account of the explosion was reported to the Gallup Sheriff's Department, and relayed to the FSS. At about 2:30 a.m. the doctor at Window Rock again called the Gallup Flying Service, inquiring about the emergency flight. The owner of the service, Jim Shephard, unable to contact his pilot employee, had then taken off in another airplane over the usual route to Window Rock. He tried to spot any sign of the other airplane on the ground, but he saw nothing. Shephard said that during his flight there were clear skies and smooth air, with only a very few small patches of ground fog. It was quite dark, but he was able to make the flight to the hospital and on to Albuquerque easily in VFR conditions.

Shortly after daybreak an air search over the route located the missing aircraft's burnt wreckage.

Official weather observations made during the night at Gallup confirmed Shephard's view that VFR conditions prevailed. At 1:34 a.m. the ceiling was estimated 4,000 feet broken, 25 miles visibility; and at 2:36 a.m. visibility was still 25 miles, although the estimated ceiling had gone down to 3,000 feet thin broken. The area between Gallup and Window Rock is high plateau country with ravines, hills, and ridges but no abrupt rise in the terrain. The elevation at Gallup is 6,468 feet, and at Window Rock it is 6,737 feet, so that a pilot flying there would anticipate climbing en route. Weather was ruled out as a cause or factor.

Schleede next focused his attention on the pilot. From interviews conducted with the pilot's friends, relatives and associates, his personality and behavior appeared to have been normal, with no suggestion of any suicidal tendencies. A postmortem examination failed to turn up any evidence of pre-existing or incapacitating disease, or the presence of drugs or alcohol. The pilot, 25, was properly certificated and qualified for the flight. His most recent Class II medical examination had been completed only one week before the flight. He was considered a competent, responsible pilot by the owner of Gallup Flying Service.

Given the short duration of this flight, the possibility of the pilot's having dozed off also had to be ruled out. However, one possibility that remained was that the pilot, having recently emerged from a deep slumber, had been less than normally attentive to his instruments and perhaps misread his altimeter. It is a known fact that some individuals are more affected than others by the "diurnal" or daily rhythmn of life, and have difficulty maintaining a state of alertness at night, especially when they are not called upon to work a night shift regularly. A pilot may appear to be fully awake and functioning normally, but in fact (and without his being aware of this fact) he may be functioning at a low ebb physiologically, and miss some details that would never escape his attention in daytime or under more stimulating conditions.

Night flights by solitary pilots figure prominently in the annals of aircraft crashes or disappearances for undetermined reasons. The combination of solitude, boredom, monotonous engine drone, and lack of visual stimulation (typically these flights are made over sparsely settled terrain or over bodies of water, such as flights to the Caribbean islands), appears to be very conducive to all forms of inattention, from grogginess to deep slumber. At certain hours of the night some individuals experience a periodic

energy depletion, which may overcome their concern over survival. As is well known, a fatigued person can slip from full consciousness into slumber without being at all aware of what is happening. There is also a condition known as "mini-sleep" in which the individual's eyes are open but remained fixed in one direction, absorbing almost no information.

Half of the accidents (23 of 45) in a recent two-year tabulation of crashes in which pilot fatigue was indicated as a cause or factor occurred at night. Of 28 fatal fatigue-related accidents, 20 were at night and accounted for 68 of 81 of the total fatalities in these accidents. Some typical examples:

- A 2,800 hour private pilot, accompanied by his wife, infant daughter, and a family friend, departed Sunnyside, WA at 1:25 a.m. local time September 1, 1979 in a rented Piper *Cherokee*. They had planned a weekend in Reno, NV. Estimated time en route was 4 hours and 20 minutes. The VFR flight plan (the pilot was not instrument rated) indicated a route via the Dalles, WA; Redmond, OR; Lakeview, OR; and Goose Lake, OR at a cruising altitude of 8,500' MSL. The flight progressed normally for an hour and a half as the 52 year old pilot checked in at various flight service stations and air traffic facilities along the way. The last contact was with the Redmond FSS at 3:04 a.m. local time.

Shortly after 4:15 that same morning an ELT signal was heard in the vicinity of Lakeview, OR. Search teams located the wreckage of the *Cherokee* late that same day, 16 miles due west of Lakeview VOR at the 8,364' (MSL) level of Gearhart Mountain. All on board had died.

NTSB investigation revealed no pre-existing problems with the airplane. Lakeview VOR was rechecked and certified functional. Lakeview weather throughout the night had been clear with no significant cloud cover and excellent visibility. The pilot, a nightshift worker, was properly certificated and current, his only limitation being the wearing of corrective lenses for near and distant vision. His Class III medical had been renewed on August 1, 1979, exactly one month before the accident. Autopsy and toxicological reports showed no evidence of drugs, alcohol, or carbon monoxide.

Investigators flagged this accident as pilot fatigue when their research revealed the pilot had flown three or four hours the morning of August 31, and then gone to work, arriving home after midnight on September 1. *Without sleeping*, he gathered his passengers and drove the few miles from his home in Grandview, WA to the airport at Sunnyside for a 1:25 a.m. departure. Less than three hours later he crashed in unobstructed terrain with clear visibility. *Were his eyes open?*

- At 2:02 one mid-September morning, the pilot of a cargo-carrying Beech-18 reported an inflight fire (in the area of the left wing flap and engine) to the Grand Rapids, MI air traffic control tower. A controller immediately turned the aircraft toward Hastings, MI airport 10 miles away. Five minutes later, the 33 year old pilot and his three passengers were dead.

Once again the pilot was healthy and current, with just over 6,000 hours—1,300 of them in twins similar to what he was flying. No drugs or alcohol were found in his blood. He had just recently passed a company proficiency check and was found to be thoroughly familiar with emergency procedures, including inflight fires. The BE-18 was equipped with an engine fire bottle activated from the cockpit. It had been discharged, but investigators were unable to tell if the pilot or the impact was responsible.

Following investigation of this accident by the National Transportation Safety Board, pilot fatigue was cited as one of the cause factors, presumably on the assumption that in his fatigued condition the pilot may not have followed the flight manual's instructions correctly for shutting off fuel supply to the heater in the wing, where the fire originated. An examination of the wreckage showed the iris controlling air/fuel flow to the heater to be half open.

The day before the accident the pilot had come on duty at 2:36 a.m. and flew from Grand Rapids, MI to St. Louis, MO. At 5.52 a.m. he left St. Louis for a return to Grand Rapids, arriving at 8:12 a.m. The pilot remained on call at the airport for his next trip, which was not until 2:55 that afternoon when he again departed Grand Rapids, this time for Chicago. At 3:42 p.m. he left Chicago and arrived at Baltimore, MD at 8:26 p.m. After off-loading his cargo and taking on three non-revenue passengers, he departed Baltimore at 10:42 p.m. When he crashed just after 2 a.m., he had been on duty for 23½ hours and had flown nearly half that time.

Night flights are not inherently dangerous, as long as pilots are aware of the possible hazards and take steps to forestall them. Of prime importance is beginning the flight in a healthy, well-rested condition, which would include several hours of sleep during the day. Safety is well served by flying with a companion, preferably another pilot but in any case someone capable of sustaining conversation and not likely to doze off at the first opportunity—sleep can be contagious. Other sources of helpful stimulation are frequent ATC communications, periodic instrument scanning, inflight snacks, and occasional movement around the cabin (when the presence of a second pilot makes this feasible). In a word, activity is the key to overcoming the habitual tendence toward nocturnal numbness.

Drowsiness or fatigue is a potential underlying cause of many fatal accidents. If you have difficulty summoning up the energy to carry out routine cockpit tasks, that is a serious warning that your energy supply is low and may soon be depleted. Land at once, even if it means turning back to your departure point. A little embarrassment is worth suffering, if it helps you avoid becoming another statistic in the record book of mysterious fatal crashes. ■

(Second article in a series on physical conditions as an accident cause.)

REST AND FLIGHT

FAR Part 135.136(a)(1–2) states, "No certificate holder may assign any flight crewmember, and no flight crewmember may accept an assignment, for duty during flight time if the total flight time of that flight in addition to any other commercial flying by that flight crewmember exceeds the following during any 24 consecutive hours.

(1) Eight hours for a flight crew consisting of one pilot.

(2) Ten hours for a flight crew consisting of two pilots. . . ."

Landing—after long night flight alone in the airplane. Staying alert enroute takes effort.

Landing Images

After three quarters of a century of aviation you might think that landing an airplane had become a simple, routine matter. The fact is that over 1,800 accidents a year—two out of every five accidents in general aviation—still occur during the landing phase. Many of these accidents cause no serious injuries, but some do, and often the expense is considerable, as is the inconvenience. *What seems to be the problem?*

The great majority of these accidents occur at airports without landing aids and take place during the final stage of the approach, landing, or go-around. In short, the pilot makes some mistake in judgment during his final approach, arrives at the threshold too high or too low, or too fast or too slow or off center and is still making control adjustments at a time when he should be concentrating on his landing flare.

On a precision ILS approach, the glide slope displays the position of the aircraft relative to the desired approach angle (usually between 2.5° and 4°). When the instrument pilot breaks out of clouds and makes visual contact, he is already well established on his approach and still has continuous guidance from his glide slope instrument.

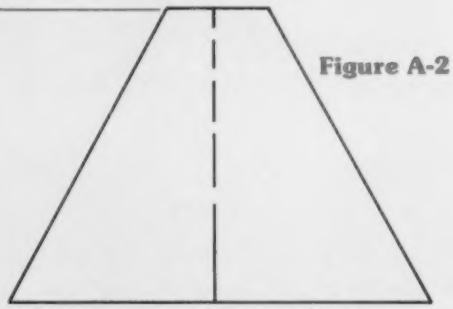
But the pilot making a non-precision or a VFR landing also has visual landing aids, of varying complexity. Many airports have approach angle guidance lights known as a Visual Approach Slope Indicator (VASI), which indicates a correct approach angle when a row of red lights is seen above a row of white lights; or the less sophisticated "Poor Man's Optical Landing Aid" (POMOLA). The POMOLA consists of three raised panels, two in front and one behind at the runway threshold, aligned so that the three panels appear in line from the air on correct approach angle. Pilots who fly regularly out of an airport without landing aids are still able to adjust their approach path by what they see, *because the shape of the runway ahead gives them specific clues regarding altitude and direction.*

A runway, obviously, is normally shaped in the form of an elongated rectangle. When viewed from the air during the approach, the phenomenon known as perspective causes the runway to assume the shape of a *trapezoid* with the departure end looking narrower than the approach end, and the edge lines converging ahead. If the aircraft continues down the approach slope *at a constant angle*, the image the pilot sees will still be trapezoidal but of proportionally larger dimensions.

Figure A-1

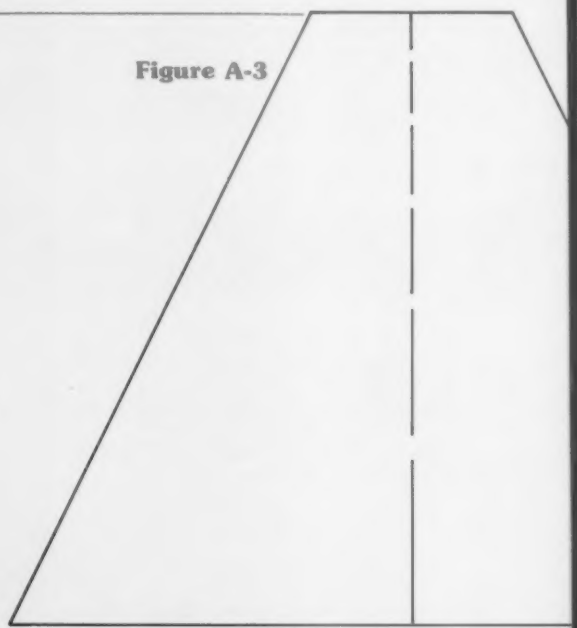
3° approach angle
4000' x 100' runway
1600' from threshold
105' altitude

Figure A-2



same runway, same approach angle
800' from threshold
52' altitude

Figure A-3



same runway, same angle
400' from threshold
26' altitude

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When the pilot establishes himself on final approach, the shape of the runway image presents important clues as to what must be done to maintain a stabilized approach to a safe landing.

For example, usually a pilot can tell that he is not centrally aligned with the runway when the centerline skews right or left of the airplane. But not all runways have centerlines, or they may be obliterated by wear or glare. Here simple geometry becomes a landing aid. If the shape of the trapezoid is nonsymmetrical—if the converging sides are of *unequal* length—then the approach is off center.

Figure B

3° approach angle
Runway: 4000' x 100'
1600' from threshold
Altitude 105'

Aircraft aligned left of centerline

The basic figure (A1) is the pilot's view of a runway seen from slightly more than a quarter-mile out on final, with a 3° approach angle, altitude 105'. An approach that is slightly higher or on a steeper glide path (say, 4°) will make the runway seem longer and the ends narrower, looking more like a rectangle because the viewing angle has changed.

Figure C

4° approach angle
same runway
1600' from threshold
140' altitude

An overly high approach (6°) to the same runway will show an even longer, narrower, and more nearly rectangular shape.

Figure D

6° approach angle
Runway: 4000' x 100'
1600' from threshold
Altitude 210'

A slightly low approach (2°) will make the runway appear shorter and wider.

Figure E

2° approach angle
same runway
1600' from threshold Altitude 70 feet

A very low approach (1.5°) will flatten the trapezoid even further.

Figure F

Which is the longer runway, right or left?

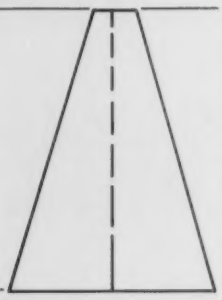
In fact, of course, both photos show the same runway, seen from approximately the same distance out from the threshold but seen on two different angles of approach.

By adjusting his glide angle to bring the runway image into the proper proportions, the pilot assures himself that he is on a normal glide path.

A problem sometimes occurs when pilots who are very familiar with the shape of the runway at their home field forget that they must make adjustments for runways of different configurations. The trapezoid figure can still cue the pilot on the correctness of his approach—if he knows what to look for.

For example, this is how an 8,000′ by 100′ runway would appear 1600′ from the threshold at an altitude of 105′, on a 3° approach.

Figure G



When the pilot mentally compares this image to the 4,000′ runway we selected as the basic image, he may feel he is too high. To him the runway appears long and narrow, as it would at a greater than 3° approach angle. The pilot may reduce his approach angle and undershoot—unless he is prepared to adjust his mental image to an 8,000′ runway. The effect is accentuated if the runway happens to be long *and* narrow.

Figure H

same approach,
runway 8000′ x 50′

Similarly, on a standard approach to a 2,500′ runway, the pilot would see a shorter, flatter than usual image, giving him the impression he is too low on his approach. He might increase his altitude excessively and overshoot—unless he remembered to make the appropriate mental adjustment.

For instance, a 25-year-old corporate pilot was assigned to transport a company executive in the firm's Cessna 210 from home base in Farmingdale, NY on Long Island to a construction site in Mattituck, NY, also on Long Island. Weather that day in late January 1980 was good—ceiling 7,000 feet and visibility seven miles, winds light and variable, with the forecast for Mattituck, 43 miles away, essentially the same.

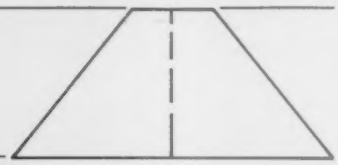
Pilot and passenger departed on time at 9 a.m. and 25 minutes later arrived in the Mattituck area. From UNICOM (Mattituck is uncontroled.) the pilot learned the landing runway was 10 and began his approach. Witnesses (including the manager of the FBO there and a mechanic) noted the 210's approach was high and fast. The aircraft subsequently touched down at the midpoint of the runway, and heavy braking was applied to no avail. The airplane skidded off the runway, down an embankment, and into a swamp. No one was hurt but the airplane was badly damaged.

Runway 10 at Mattituck was 2,200′, less than half of the 5,500′ runway at Farmingdale. It was still adequate for the 210 under existing conditions—but only with a normal angle approach. The flattened image which appeared to the pilot could have made him believe he was low on final, and overcompensating could have led to an overly steep and fast approach.

A wider-than-average runway seen from a standard 3° approach angle may also give the pilot the impression he is lower than normal. His airspeed, altitude, and power settings may indicate he is on the proper approach path, but the unfamiliar image he sees suggests he is closer to the ground than he should be.

Figure I

3° approach angle
4000′ x 150′ runway
1600′ from threshold
Altitude 105′



Similarly, a runway that is *narrower* than average gives an impression of being too high, possibily leading to a low approach and an undershoot, unless the pilot considers the runway dimensions in advance and anticipates an altered image.

Figure J

3° approach angle
4000′ x 50′ runway
1600′ from threshold
Altitude 105′

Regulations require that a pilot familiarize himself with only the runway lengths at his destination. Not much thought may be given to the runway width. However, from the above examples, it would seem runway width also deserves some attention from the pilot. Sectional charts give only the length of the longest runway at an airport. Width and other details can be found in the FAA Airport/Facility Directory.

The examples seen thus far are of level runways on level terrain, an ideal situation not always found at airports, particularly in mountainous areas. Terrain and even runways themselves can slope, however slightly, and this may cause the landing image of the runway to be altered. By FAA specification, runway and terrain slope angle, if possible, is kept to a minimum—usually no more than ± 2°.

Here is the same basic 4,000′ by 100′ runway, except that it slopes upward away from the threshold by 2°. The approach criteria are the same: 1600′ from threshold, 3° approach angle, and altitude 105′. (Note: the approach angle of 3° is formed by an imaginary line drawn through the touchdown point on the runway and has no relationship to the slope of the runway.)

Figure K

3° approach angle
4000′ x 100′ runway
+2° runway upslope
1600′ from threshold
Altitude 105′

When this image is compared to that for a level runway of the same dimensions, it appears longer and narrower, making the pilot seem too high. If the pilot "corrects" his approach angle downward, his approach path over the final terrain segment will be low, and he might collide with obstacles or land short of the threshold. The same sized runway with a 2° downslope from the threshold displays a flatter image than a level runway, suggesting to the unwary pilot that he is too low and resulting in overcorrection. Knowing the runway slope angles in advance, the pilot can avoid unnecessary corrections and make a consistent normal angle approach.

Figure L

3° approach angle
4000' x 100' runway
– 2° runway downslope

The appearance of the *terrain beneath the airplane* also affects the pilot's judgment as to the correct height of his approach. Normally the terrain is fairly level. If it slopes, it helps to know that in advance in order to adjust the approach path properly.

If terrain slopes upward from the threshold, the pilot may necessarily have to adjust his approach angle upwards to assure terrain clearance. If the runway is long enough to establish a touchdown point well beyond the threshold, there is no problem. Otherwise, the pilot would have to use a steeper than normal approach and adjust his flare accordingly.

Over terrain that slopes downward from the threshold (toward the approach aircraft) the normal approach angle may seem too high—as the pilot sees he is higher than usual above the terrain—unless he is unaware of the slope. If he reduces his approach angle to maintain a normal height above the final approach terrain, he may undershoot.

The miscues that sloping terrain produces can make victims of even high-time airline captains, as a B-727 pilot discovered recently.

On November 21, 1980 a combination cargo/passenger flight crashed on approach to runway 7 at Yap, in the Western Caroline Islands, after an uneventful flight from Saipan via Guam. The weather was clear, the winds light. The 727 touched down 13 feet short of the threshold on the right main gear, which broke off. Taking out a bamboo runway marker, the 727 slid 1700' and came to rest in the jungle off the right side of the runway. All 73 on board survived, although the aircraft was destroyed by fire.

Runway 7/25 at Yap is 4,820' long and 100' wide, consisting of compacted coral and an asphalt seal 75' wide. There are no VASI lights and no markers painted on the runway surface, and the runway edges in places are indistinguishable from the surrounding jungle. An NDB is the only navigational aid. The terrain before the threshold of runway 7 and the first 60 or so feet of the runway itself slopes downward nearly 5°.

Airline procedure for this approach called for a 3° approach angle, established by specific airspeeds combined with power and flap settings, to a touchdown 1,000' from the threshold at an aiming point indicated by bamboo markers on either side of the runway.

The National Transportation Safety Board concluded that the probable cause of the accident was the captain's ". . . premature reduction of thrust in combination with flying a shallow approach slope . . ." The combination of terrain and runway downslope may have given the captain—on his first trip to Yap as PIC—a landing image of being too high, so that he amended landing procedures to compensate. The result was some badly shaken passengers and a burned-out shell of an airplane.

Information on runway and terrain slope may not be so easily accessible as runway length and width. Airports with instrument approaches will have the runway slope published on the instrument approach plate, and occasionally the slope of the terrain—if considered significant—will also be indicated. The degree of slope of a non-instrument runway or of its surrounding terrain would normally be available only from the airport manager, although an excessive slope might be publicized in a NOTAM.

Check in advance to anticipate the correct landing image—length, width, and slope—of any unfamiliar airport you plan to visit. You can also ask UNICOM from the air if anything about the runway configuration or condition is unusual. Adjust your mental image as needed, and you will have a simple, reliable landing aid. ■

The gap at Yap. Jungle clearing in the Caroline Islands of the South Pacific contained an adequate runway but deceptively sloping terrain mislead jetliner crew, leading to near fatal crash.

TCAS *How the newly selected collision avoidance system will affect general aviation*

TCAS, the most recent newcomer to the galaxy of acronyms in the nation's airspace, may have a special appeal for general aviation pilots for several reasons, in spite of the expensive sound of its spelled out meaning—Traffic Alert and Collision Avoidance System.

Reason Number 1. Pilots who prefer to fly with minimal reliance upon ground control stations will be able to do so and still receive warnings about nearby air traffic.

Reason Number 2. TCAS will provide an additional tool for reducing the possibility of midair collisions, which account for an average of over 50 deaths per year in general aviation.

Reason Number 3. It is not planned to be mandatory. You can forget about it if you wish.

In the past decade there have been 306 midair collisions, and all but one have involved at least one general aviation aircraft, with the smaller aircraft usually getting the worst of the encounter. These figures are modest indeed, in comparison with automobile collision accidents and fatalities, but now that the state of the electronic art has made it possible to give automated early warnings of potential conflict, the opportunity exists to make the midair collision an even more remote likelihood than it is now. The current trend toward a larger proportion of high performance aircraft in use, including many turbine-powered aircraft, reduces the time remaining for any appropriate evasive maneuver once an aircraft on a convergence course has been spotted by a pilot. The extra few seconds afforded by a TCAS alert could mean the difference between life and death.

The heart of TCAS is an improved version (Mode S) of the familiar airborne transponder carried on board about three out of every four active aircraft. Airborne transponders reply automatically to radar signals, providing information which may be used to determine relative position and altitude. The principal difference between the new Mode S transponder and the transponder in use today is that with Mode S each aircraft has a unique address capability. With the selective address feature, "private line" air-to-air and air-to-ground data communications can be used in various collision avoidance applications.

TCAS I provides, in addition to the Mode S transponder capability, a specially designed receiver that will alert the pilot by means of a horn or light when another transponder in his vicinity replies to ground radar signals.

TCAS II, the air carrier version of this system, will include an airborne radar component capable of interrogating all transponder-equipped aircraft within a range of interest. Additionally, aircraft equipped with Mode S transponders may be addressed on a selective basis. This unique address, or "private line" feature, will make possible much faster communications between air traffic, and eventually also between suitably equipped aircraft and ground facilities, as Mode S is phased into the air traffic control system.

When opposing traffic is detected by TCA II, such information as intruder range, speed, bearing, and altitude may be instantly presented to the pilot along with appropriate evasive action (dive or climb).

Two opposing air carriers which are equipped with TCAS II will be able to "talk to each other," i.e., exchange relative position data and maneuver intentions, using the discrete address radar signal.

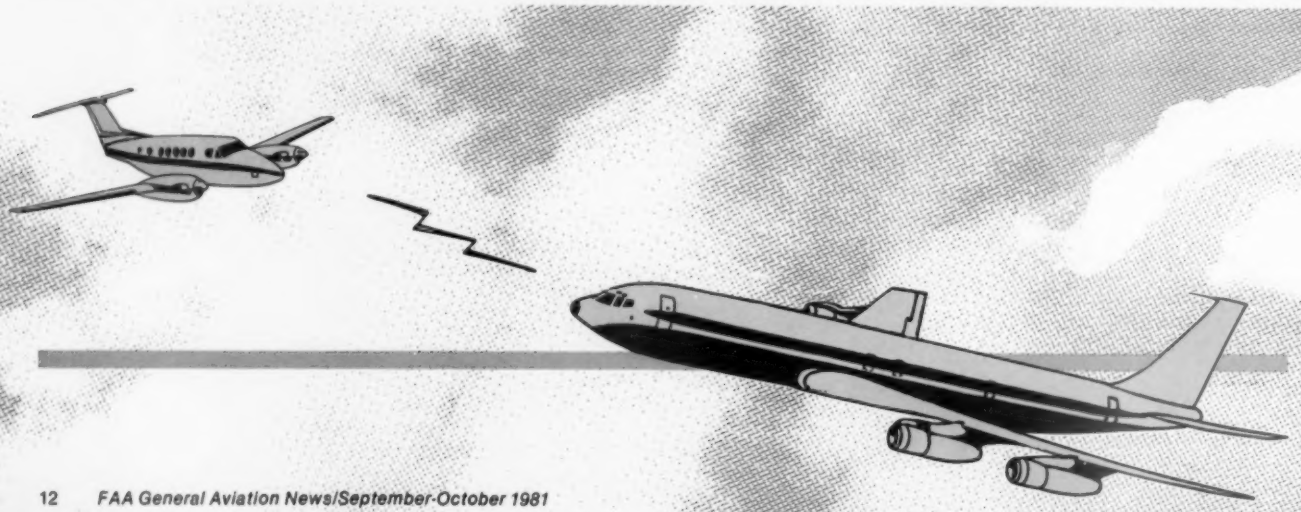
If the TCAS I aircraft is in conflict with the more complex TCAS II equipment, the TCAS II aircraft will transmit a message to the Mode S transponder in the TCAS I, warning of the conflict.

It is anticipated that a TCAS I unit which includes the Mode S transponder and a pressure altitude encoder will market for less than $2,500.

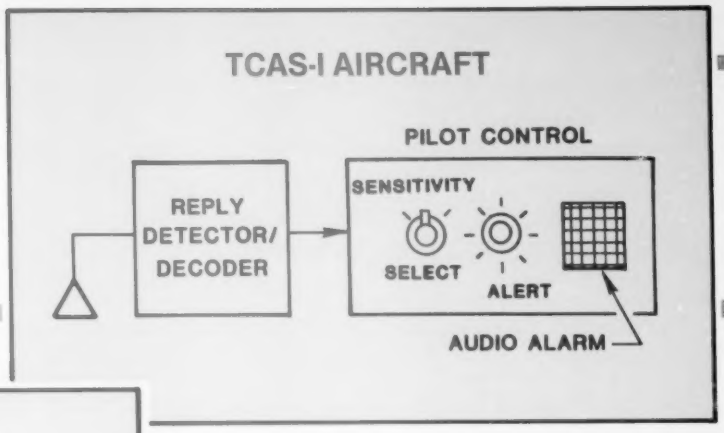
The need for some kind of collision avoidance system which could be effective without becoming mandatory on all aircraft has been debated in aviation circles for more than a dozen years. The size of the civilian aviation fleet and the number of pilots has increased steadily over that period. Active airmen number over 800,000 and the fleet now totals about 210,000. Statistical projections indicate we will have over a million pilots by the end of this decade and perhaps 300,000 aircraft. This does not necessarily signify "crowded skies," but it does mean that air traffic density in many terminal areas will increase.

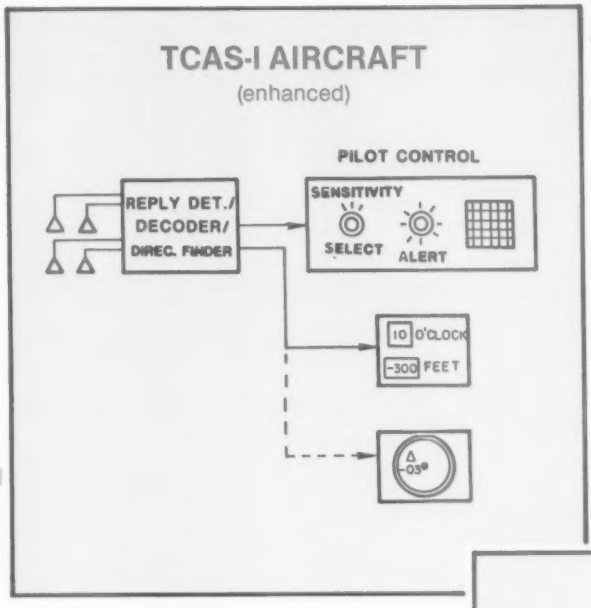
Studies of midair collisions or near midair collisions show that the great majority of these events take place in terminal areas *and involve at least one aircraft which is not receiving radar separation advisories from air traffic control.* The FAA-validated data on near midair collisions for a recent 2½ year period showed more than 600 near midairs took place under such conditions.

Periodically—especially in the aftermath of an air disaster like the San Diego accident of May 1978, in which 135 persons died on board an air carrier—public sentiment calls for curbs on general aviation flying, in the name of safety. TCAS, which is scheduled to become available before the end of 1984, appears to offer a more desirable and realistic course of action. ■



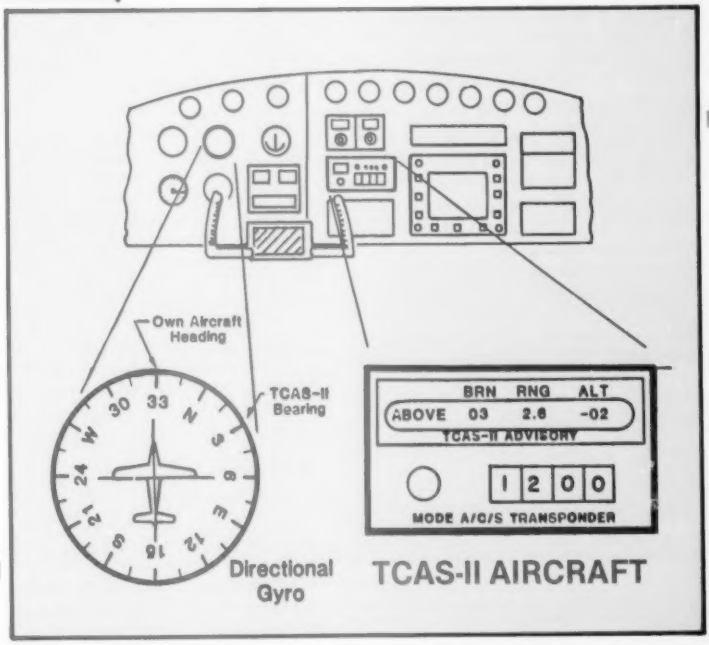
Schematic drawings of possible cockpit displays for TCAS I (top, left) and TCAS II.





Sensitivity control would permit a pilot to determine the range of airspace he wishes to have scanned.

Air-to-air transfer of information on a selected address basis will be accomplished with TCAS II, covering range, bearing and altitude.



Proposed Rule for Ultralight Airspace Operations

FAA is proposing that "ultralight" vehicles, such as powered or non-powered hang gliders, be made subject to certain operating and flight rules. Ultralights are defined as single-occupant, manned-flight vehicles that weigh less than 155 pounds, have a fuel capacity of 15 pounds or less, and have no U.S. or foreign airworthiness certificate. The agency believes that unrestricted use of ultralight vehicles may pose a hazard to other craft in highly traveled airspace.

Under the proposed regulation, ultralight vehicles would need air traffic control authorization to operate in control zones and airport traffic areas and in Terminal Control Areas. Operation in restricted or prohibited airspace would have to be coordinated with the specific controlling agency. Operations would be prohibited over heavily populated areas of cities and towns and over open-air assemblies of people. Dropping objects or operating the vehicle in a hazardous manner would also be forbidden.

Ultralights would have to conform to VFR flight visibility and cloud clearance requirements and be operated so that visual reference to the ground can be maintained. Operations would be restricted to between the hours of sunrise and sunset. An ultralight would have to yield right of way to all aircraft and other vehicles in flight, and the operators would have to permit inspection by an FAA official at any time to determine compliance with the regulations.

Copies of the notice of proposed rulemaking are available from FAA Office of Public Affairs, Public Information Center, APA-430, 800 Independence Ave., S.W., Washington, DC, 20591. Ask for Notice No. 81-6. Comments, due by November 25, 1981, should be sent to FAA Office of the General Counsel, AGC-204, Docket No. 21631, same street address.

IFR Rating Exemptions

Under a recent rule change, the pilot-in-command of a Part 135 (air carrier) aircraft is required to have an instrument rating and remain instrument proficient to carry passengers for hire. However, pilots flying in areas where electronic navigational aids are sparse or where terrain limits their effectiveness, may be exempt.

The areas would have to be sparsely populated, and the operator would have to show that flights depend primarily on pilotage because of the lack of NAVAIDS. In addition, the areas would have to be isolated in the sense that no major highway runs nearby, no alternate form of transportation to the area exists (e.g., no bus or train lines), and air travel is the primary means of reaching the area. Aircraft would have to use unimproved strips or lakes; flights could not exceed 250 nautical miles and must remain within the predesignated area.

Any operator who believes he meets these requirements should contact his local General Aviation District Office for the proper application procedures.

LATEST FAA PUBLICATIONS

Unmanned Balloons

How to apply for waivers of FAR Part 101 (Moored Balloons, Kites, Unmanned Rockets and Unmanned Free Balloons) is explained in updated Advisory Circular 101-1A, "Waivers of Part 101, Federal Aviation Regulations." The circular is free from DOT Publications Section, M-443.1, Washington, DC, 20590.

Retroreflective Markers

New specifications that incorporate advances in reflector technology can be found in Advisory Circular 150/5345-39B, "FAA Specification L-853, Runway and Taxiway Retroreflective Markers." Airport operators planning to replace or install retroreflective markers might be interested. Free from DOT Publications Section.

Model Aircraft

Safety practices for model aircraft enthusiasts are outlined in Advisory Circular 91-57, "Model Aircraft Operating Standards." The circular suggests how model aircraft hobbyists can keep from endangering themselves, spectators, or even full-sized aircraft by following a few sensible rules. Free from DOT Publications Section.

Operating and Flight Rules Slated for Major Overhaul

After nearly a half century of accumulation, the General Operating and Flight Rules (Part 91 of the Federal Aviation Regulations) are scheduled to undergo a thorough reorganization which will make this venerable "Airman's Bible" much easier to use and understand. No rule changes are envisioned at this time.

FAA has proposed rearranging the entire format so that each section, or subpart, will contain only rules that relate to each other, and are presented in a logical sequence. The five existing subparts would be purged of all regulations which do not normally affect most general aviation flying, and this material would be placed in five additional subparts.

The proposal is part of the President's reform program to simplify government regulations.

Persons wishing to examine the proposed new format may send for a copy of NPRM 79-2A, free from the Office of Public Inquiry, APA-430, 800 Independence Ave., SW, Washington, DC 20591. Comments will be considered until December 9, 1981, and should be sent to the FAA Office of General Counsel, AGC-204, Docket No. 18334, same street address. For further details, contact Fred Laird, 202-426–8150.

Breath Tests for Alcohol

Enforcement of the Federal Aviation Regulations prohibiting aircraft operation while under the influence of alcohol would be made more practical under a proposed rule change authorizing FAA inspectors to administer chemical breath tests.

The rule would require any crewmember attempting to fly an aircraft in an apparently intoxicated condition to pass a breath test when so requested by an inspector. Test indications of alcohol in the blood in the amount of 40 mg. per 100 ml. or more would be grounds for an enforcement action.

The current regulation, which requires an eight-hour abstention between "bottle and throttle," has been difficult to enforce. Outward indications of alcohol incapacitation vary considerably, and inspectors have lacked authority to make any kind of on-the-spot anlaysis of an airman's condition. Nearly 90 percent of the aircraft accidents attributed to alcohol are fatal. Copies of the proposed rule can be obtained from Office of Public Inquiry, APA-430, 800 Independence Ave, S.W., Washington, DC, 20591. Comments should be sent no later than November 25, 1981 to FAA Office of the General Counsel, AGC-204, Docket No. 21956.

PAPI VS VASI Lights

A new type of VFR approach slope lighting system is being tested at Teterboro, NJ as a possible improvement over the familiar VASI (Visual Approach Slope Indicator). Called PAPI (for Precision Approach Path Indicator), the new system uses a special focusing lens in the light boxes to provide more distinct color transition, enabling the pilot to more easily assess his approach angle.

• Columbia Calamity

Re your "Famous Flight" on the Space Shuttle *Columbia*: I think you will find that nitrogen will not work very well as a propellant—better use hydrogen instead in the three main engines.

Robert Henry
Newcastle, WY

Absolutely correct. The fuel mixture for the Columbia's three main engines is six parts liquid oxygen to one part liquid hydrogen.

• Noisy Twins

In regards to your statement that general aviation aircraft reciprocating engines are already muffled (July/August 1981), it only applies to single-engine aircraft. Most twin-engine aircraft do not have mufflers; for example, the Cessna 310 and 340, the Beech *Baron*, and Piper *Aztec*, to name a few.

James F. Frey
Manchester, MA

It would have been more correct to say many general aviation reciprocating engines are muffled. Thank you.

• Right Seat PIC

Must a pilot have a logbook endorsement to fly as PIC in the right seat of an aircraft requiring only one pilot, such as a Piper 140, when flying VFR only?

J. D. Crownover
Mt. Clemens, MI

Seat selection up front is at the pilot's option.

• Instrument Requirements

I recently had a discussion with some flight instructors at a Cessna flight school operating under Part 141 about how many hours are required before a pilot can go for his instrument rating. Without any hesitation they all answered 200 hours. However, they couldn't show me anywhere in FAR Part 141 where this is stated. Why?

Sidney Fleishman
Sun Prairie, WI

The requirements for an instrument rating are found in FAR Part 61.65(e) and call for a minimum of 200 hours. Appendix D of Part 141 explains how an FAA certificated flight school may certify a pilot for a combined commercial and instrument rating with a minimum of 190 hours.

• Seating Children

There seems to be a contradiction in the answers to two questions regarding children and seat belts. In the January/February 1981 "Forum" you say that for Part 91 operations, children over two years of age must occupy a separate seat and be belted in that seat alone. Yet in the May/June 1981 "Forum" you said that is not so for Part 91, only for Part 121 and 125. Which is correct?

Name Withheld

The latter.

• Mincing Words

In the "Forum" for July/August 1981 you answer a couple of questions in a way that you adopt frequently but which puzzles me. You answer one question with the word "Affirmative" and another with the word "Negative."

Will you please tell me what is wrong with the one-syllable, three-letter word "Yes" or the equally forthright one-syllable, two-letter word "No"?

Bart Gould
Newburyport, MA

Nil. (The one-syllable, three-letter word for "Nothing.")

• You Asked Anyway!

Could the "why" of IAD for Dulles be as simple as "International Airport Dulles"? (July/August 1981 "Forum")

Norman Ronis
Chevy Chase, MD

The question is, why is the "D" for Dulles placed last. According to one reader, the original identifier was DIA, but in the days when aircraft information was written on strips and handed to controllers, a few sloppy writers managed to make DIA look like DCA (nearby Washington National). After an aircraft was almost vectored to the wrong airport, the change was made.

Another reply claimed that Dulles' DIA was confused with Dallas International Airport and was changed for that reason.

• Cross Country Time

In regard to a question in the May/June 1981 "Forum"—am I to understand that once I have obtained my private pilot certificate I can log flights greater than 25 NMi as crosscountry? Both of my instructors were a little unclear on the FAR, but they read it as 50 NMi. Help?!

Michael Greenberg
Littleton, CO

Any pilot can log a flight from one point to another as crosscountry time but cannot apply a flight of less than 50 NMi toward crosscountry flight experience requirements for a pilot certificate or rating.

• A Word of Thanks to ATC

After reading several articles by disgruntled pilots on the subject of air traffic control, I have intended to write for some time to report that I have been impressed with the courteous and efficient manner with which controllers have handled my flights. Recently while on an IFR departure out of Westchester County in New York, the top of the door of my twin *Apache* popped open at 6,000 feet. I told New York approach I had a minor problem with the door, and I emphasized minor. I was immediately turned over to Newark Approach and cleared to land there. Even though this problem was not dangerous to flight, it was continuously handled professionally, effectively, and efficiently by the controllers all the way to touchdown.

I am very proud to fly, work, and associate with such professionals and regard them in the highest esteem. I personally feel there is no more demanding job than that of air traffic controller.

Robert T. Ford
Rye, NY

FAA GENERAL AVIATION NEWS welcomes comments from our readers. No anonymous letters will be used, but names will be withheld on request. Address: FAA GENERAL AVIATION NEWS, AFO-807, Washington, D.C. 20591.

• Better Late Than Never?

I really look forward to getting your publication. Your recent articles on single-engine IFR, electrical failures, and IFR at night are most interesting and informative. But . . .

I have a gripe. The magazine arrives late—sometimes very late. I work just two blocks away from the FAA office at Los Angeles and on a visit in February picked up the January/February issue. My subscription copy arrived a week later. The same thing happened next issue, only it was early May when the March/April issue arrived! Can something be done?

Phil Stein
Inglewood, CA

We are trying. We use Third Class mail to keep your subscription price to a minimum, and delivery time for that class of mail is not very predictable. We intend to beat the rower's drum a little faster.

• Observer Equipment

What is the required equipment for a weather observer?

David C. Sinclair
Washaw, NC

Required equipment for a National Weather Service certificated weather observer consists of devices to measure cloud height, temperature, wind direction and speed, and atmospheric pressure.

• Viva LaCrosse FSS!

The FSS at LaCrosse, WI deserves a "well-done." This summer, while flying a *Skyhawk* from Des Moines to Tomah, WI, I experienced the lowtime (170 hours) VFR pilot's nightmare—I became lost. I was concerned about an airsick passenger and lost track of my checkpoints in the unfamiliar territory of southern Minnesota. I immediately let the LaCrosse FSS know my predicament. They had me contact Bloyer Field at my destination for DF steers, since they were not equipped. The specialist was very kind and helpful and kept reassuring me. When I began having trouble communicating with Bloyer, the FSS got them on a landline and relayed instructions, repeating them so I was sure to understand. All the while they kept telling me I was doing fine and would be all right. I landed safely at Bloyer.

I just wanted to let pilots who might become complacent, as I did, with full tanks and VFR weather that the guys in the FSS are there to help—but only if you tell them your problem. Keep up the good work!

George M. Boyd
Wichita, KS

Consider the word passed on—and thank you.

INSTRUMENT CORNER

• Landing Categories

If my aircraft is certified for Category A minimums (landing speed less than 91 kts.), and I have to circle to land at 95 kts, do I use Category A or Category B minimums?

Steven A. Briner
Ruston, LA

In this case, use Category B minimums. Even though an aircraft may be Category A certified, a landing maneuver—such as a circling approach—may require an airspeed in excess of that requirement, pushing the airplane to the next category. Those minimums should then be used.

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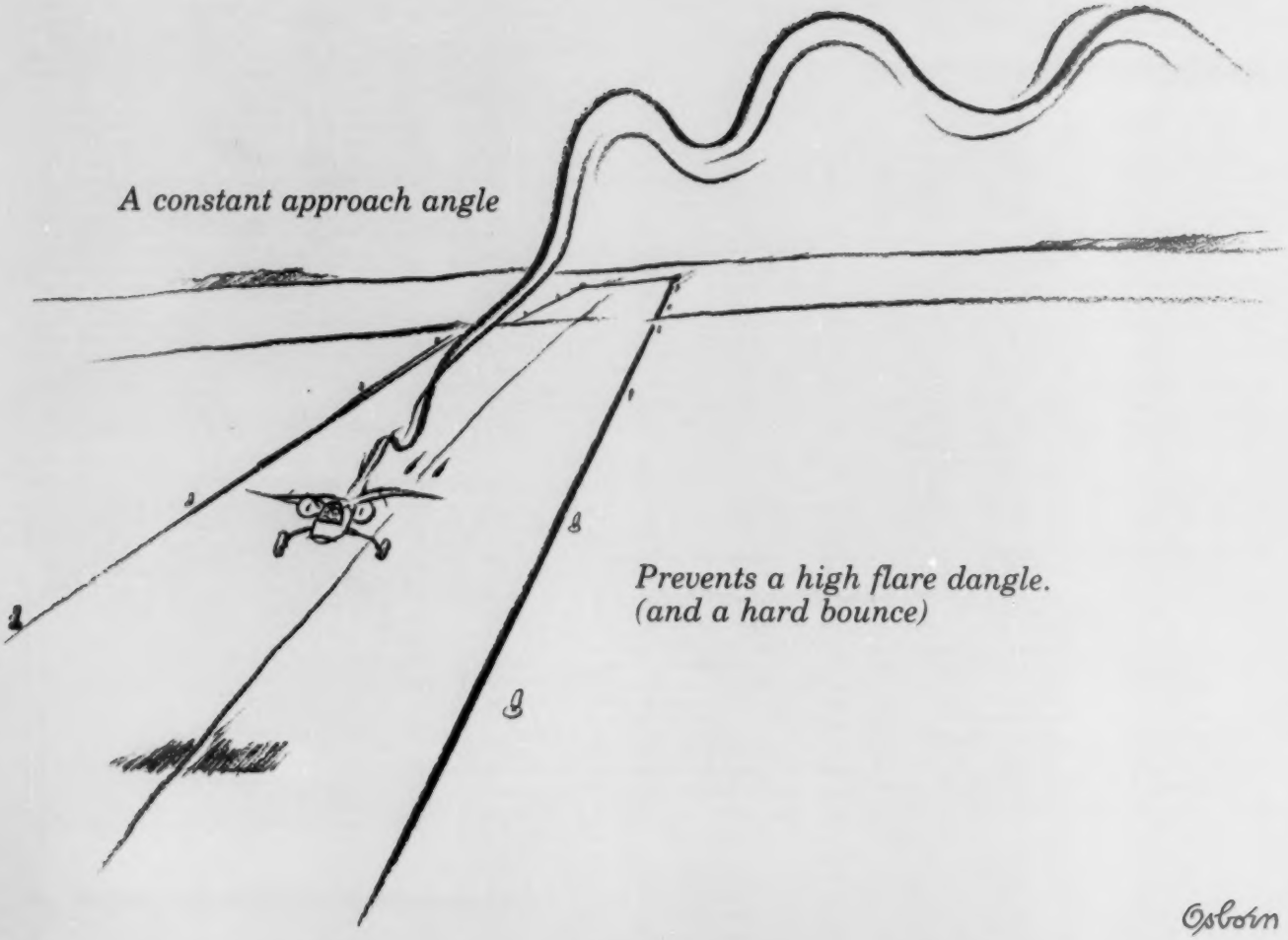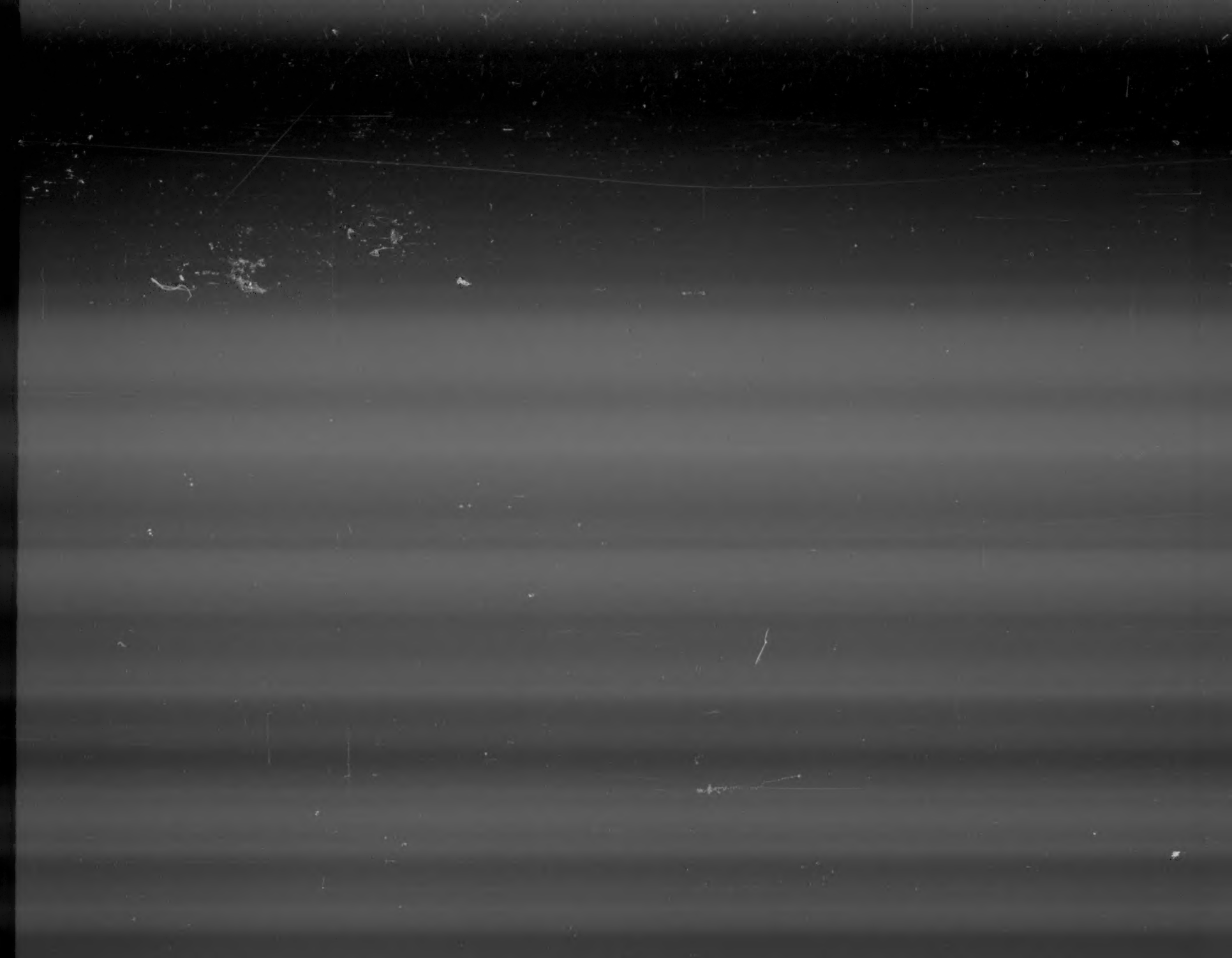
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